REVIEW.

ART. XV. *On the Nature and Treatment of Tetanus and Hydrophobia, with some Observations on a Natural Classification of Diseases in General.* By ROBERT REID, M. D. Licentiate of King and Queen's College of Physicians in Dublin, Member of the Royal Medical Society of Edinburgh, &c.

THIS is a work to which we cannot attach much value. It is a very slim, jejune, and penurious production, exhibiting a mere sketch of the history of the diseases of which it purports to treat, and even this not executed in the best manner. But it contains the modern views of the pathology of these terrible affections, with which some of our readers may be interested, and this constitutes its chief claims to our attention. Every writer, however, is to be judged, according to an old maxim, by his design—and perhaps the preceding remarks are not just to our author, since he may have aimed at little more than he has performed, and we are willing, with our usual spirit of benevolence, thus to consider the case, and to retract altogether, or soften the severity of our strictures. What he has omitted, we shall endeavour in part to supply, and present a sort of synopsis or digest of the existing state of our knowledge in relation to the subject. Inverting the arrangement of the work, we shall first apply ourselves to the discussion of hydrophobia, and from the copiousness of the matter before us, it will probably occupy as many of our pages as we can now conveniently appropriate to it, and hence we may be compelled to postpone to a subsequent occasion, our observations on tetanus.

The term hydrophobia, which means an aversion to water, does not strictly designate the disease. Cases have frequently occurred of it, without any such dread or dislike of that or other fluids. It has perhaps with propriety been remarked by MEADE, that it should have been called Δυσκαταποσις, a difficulty of swallowing, rather than Ὑδροφοβια, or dread of water. Be it as it may, that title is still inappropriate, as derived from a solitary symptom, instead of the general character of the disease. Being more prevalent among dogs, it is also called rabies canina. As however other animals are occasionally the subjects of the disease, a more comprehensive name should be conferred on it. But since that of hydrophobia seems now to be conventionally adopted, we shall retain it in the ensuing inquiry.

The curiosity commonly entertained regarding the origin of diseases, excites a regret that the early notices of them are often involved in obscurity. Those who contend for the antiquity of hydrophobia, cite certain passages from HOMER, in which the figure of canine rage is employed to illustrate the vehemence of turbulent and exasperated passion. But these passages seem to refer rather to the ordinary fury of that animal than to any specific madness.

Neither by HIPPOCRATES nor CELSUS, or by any other writer of these periods is the disease mentioned. It is said, though we never could find it in his works, to be noticed by ARISTOTLE. CŒLIUS AURELIANUS, who lived much later, is the first authority who distinctly treats of it, and from his having entered into a long discussion of the question, whether hydrophobia was a new disease or not, it is presumable that it had attracted little attention previously. It is asserted by PLUTARCH and LE CLERC that it originated in the time of ASCLEPIADES, who lived in Rome from the beginning to the middle of the first century. But this is questionable. Equally uncertain are several other points connected with the history of the disease, and among which, not the least interesting, is the mode in which it originated. Did it primarily arise from a specific contagion, on which it continues to be dependant, like variola and similar cases, or was it generated, and still is occasionally, by some general causes? The former is the common and best sustained opinion, though there are not wanting some who hold the opposite view of the subject, and hence the disease has been divided into traumatic and spontaneous, as excited by a peculiar virus inserted in a wound, or as proceeding from ordinary morbid agencies.

Nor is it determined with what class of animals it commenced, or to which it is restricted. The former point it is idle to discuss, and as for the latter, all we know with certainty is, that besides the human species, it is met with in the canine, the feline, the equine, the bovine, and particularly in dogs. To these BOERHAAVE adds poultry as sometimes affected, which seems contrary to common experience. The disease however may occur in other animals, eluding our attention from the slender opportunities afforded of observing it in their wild or undomesticated state.

There is much reason to conclude, from a review of the most familiar and authenticated facts, that it commenced in dogs, and has ever since in the human subject undoubtedly, and probably in all other instances, been communicated by a virus, the result of a specific secretory process peculiar to the canine race. No other animal has the faculty of reproducing the contagious matter. Cases indeed are recorded, one of which came under our own care, where the disease was supposed to have been excited by the bite of a rabid cat. But as such instances are of rare occurrence, which would not be so, from our constant exposure to that animal, had it such a power, it may be presumed that it was otherwise acquired, or was mistaken for some of those nervous affections, sometimes very closely imitative of hydrophobia. It is reported, we are aware, that it has been communicated to other animals by MAJENDIE and BRESSLET by inoculation with the saliva of a man in the disease, and that a similar result was produced by Mr. KING, from that of a rabid cow inserted into a fowl.[*] But this is improbable in itself, and is rendered still more so, as being in contradiction to similar experiments made by other persons.[†] The apparatus in the dog for the secretion of saliva is very peculiar, and by virtue of which it may be presumed it exclusively possesses the faculty of elaborating this virulent product.

By what single or combination of circumstances it had its origin, it were vain now to inquire: but we are not without grounds to suspect, that though at present it may not be generated, *de novo,* there are causes which predispose to or excite this disease, and at all events, promote its prevalence in dogs.

1st. *Confinement of these animals in narrow, hot, and ill-ventilated places.*—It is notorious that packs of hounds thus situated, and even a single dog habitually chained and kennelled, is liable to become affected.

2d. *Diet either scanty or putrid.*—BOERHAAVE and his commentator, VAN SWIETEN, are decidedly of this opinion, and YOUNG, in his Annals of Agriculture, says, "that canine madness chiefly arises from the number of ill kept and ill fed dogs." It is affirmed that formerly when horses and other animals which died in this city were thrown on the commons unburied, and dogs fed on the carrion, rabies was frequent, which has comparatively ceased since the discontinuance of the practice. The same has been remarked after battles in warm climates, and it is known, that in the season of the fisheries on our great water courses, especially on the Potomac, where large quantities of fish are permitted to remain to putrify, that the disease to a greater extent is an usual consequence.

3d. *Deficiency of water.*—An impression of the influence of this cause is so strong that it has attracted legislative interposition, and provisions have been made accordingly in some of the West India Islands, for a supply of it at certain periods of drought.

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[*] Medical Gazette, No. 27, July, 1828.

[†] Hunter, Arnold, &c.

4th. *Extreme Heat.*—The connection of the disease with a high degree of temperature was observed by some of the earliest writers on it, and we believe that our own experience teaches that it prevails almost exclusively in our hot weather. But such is not the case every where. As to the West Indies, it is difficult to determine the point. By HILLARY it is considered as endemial to the tropical regions, while other writers as MOSELEY, &c. of equal authority, represent it as of the rarest occurrence. On the continent of South America it is said not to be known—the same is asserted by VOLNEY as to Egypt and Syria, and by BARROW with regard to the Cape of Good Hope. But these were travellers, whose observations, hurried and deficient, are not always to be trusted.

5th. *Epidemic Distemperature of the Atmosphere.*—Not a few very interesting facts are collected by WEBSTER, showing the simultaneous spread of the disease with pestilential fevers, as well here as in other countries. But the most conclusive evidence on this point is given by MOSELEY in his work on tropical diseases. He states that "in the spring of 1783, hydrophobia broke out in Hispaniola, and subsequently in Jamaica, and raged in the latter island to a wide extent till the next year. It seemed to be dependent on a vitiated state of the air, since the disease was general, and many dogs were seized with it that had no communication with others, and some dogs that were brought from Europe and North America, and which were not on shore, went mad on their arrival in the harbours."

Notwithstanding what may be found to the contrary as regards its spontaneous origin in the human species, there is not the slightest proof deserving of confidence.* It is however true, that in many diseases, as malignant fevers, where the cerebral and nervous systems are much disordered, and more especially in the neuroses, as hysteria, epilepsy, and tetanus, as well as in certain forms of gastritis, great difficulty of deglutition occurs, attended by an exquisite sensibility, betraying an intolerance of light, or noises, or fluids, or even of a draught of air. But such cases are essentially different, and it would require a very vague and sweeping generalization indeed to comprehend them under the same denomination, and in violation of every rule of nosological distinction and arrangement.

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* By most of the old writers this opinion was maintained. Cœlius Aurelianus, and Aretæus are very explicit on the point, and Boerhaave says "that though more commonly produced by derivation, yet it appears both from history and observation to have arisen spontaneously in some acute diseases." The same language is held by Van Swieten, who expressly declares "that it has been excited in human bodies without any received poison from a mad animal."

In the further discussion of the subject, we shall confine our remarks to the disease as it exists in the human species, and it may be collected from what we have said, that its only probable cause is the virus of a rabid animal, and most generally, and perhaps exclusively that of the dog. Besides the actual insertion of the contagion by a bite, the disease is asserted to have been imparted by the slaver taken upon the lips or tongue, by biting off a thread which had been used in mending a rent in a garment from the bite of a rabid dog,[*] also by kissing a rabid animal,[†] and likewise by a cut with an instrument used years before, in killing a mad dog.[‡] Cases are moreover related of its having been conveyed by the saliva taken into the stomach,[§] and by eating the milk and flesh of animals which have died of the disease[||]—and by dissection of such animals—and it is further said to have been received from a scratch made by the claw of a mad cat,[¶] and lastly by the breath of a rabid animal.[**] More than one of these averments are, however, obviously erroneous. It is well ascertained that the milk and flesh of infected animals have been eaten with impunity, and that dissections of them have been often performed, and in no instance, so far as we have heard, with any sort of injury. The universal escape of the attendants on the subjects of the disease who are exposed to every source of exhalation, argues strongly, independently of other reasons, against the possibility of communication by the breath or any other vehicle of contagion, and not less against the danger of infection from depositions of the saliva on the skin, if there be no abraded or ulcerated surface exposed. The unfounded tales of this description have led to much mischief, by exciting a timid and cautious solicitude, preventing not only the exercise of those attentions towards the unfortunate sufferers, which humanity and a sense of duty inculcate, and the successful treatment demands, but they have operated to retard the progress of the investigation of the disease.

No circumstance connected with this subject, is of greater curiosity or more mysterious complexion, and difficult explanation, than the length of time which the virus will remain in the system in a state of inactivity. It is not, however, without analogy. Miasmata, we are aware, will do the same, and as instances of closer similitude, the variolous and vaccine contagion may be adduced, each of which

[*] Cœlius Aurelianus, Hildanus, Hamilton.

[†] Palmarius, Shenkius.

[‡] Shenkius.

[§] Palmarius.

[||] Fernelius.

[¶] Hildanus.

[**] C. Aurelianus, Aretæus, Boerhaave.

is occasionally dormant for weeks or months. Yet these latter examples are of very rare and anomalous occurrence, which is not the case with the hydrophobic virus. It observes no certain or definite period in the development of its action, for the disease has appeared in all the intermediate periods, from the third day to an indeterminate length of time. Cœlius Aurelianus says a year or more—GALEN informs us that he saw a case which broke out after a year—Meade one after eleven months, and another has lately been reported of nine months.[*] The most common period of the attack, according to AURELIAN, MEADE, and HAMILTON, is from twenty to forty days, and the latter writer, who has most elaborately investigated the subject, affixes the tenth day as the earliest, and nineteen months as the remotest period of its development. Cases, however, are recorded where the attack was protracted to the extent of twenty, and even forty years, but they are derived from apocryphal authority, and impose no credibility. Many causes have been assigned for these diversities, without however, any satisfactory explanation, such as the degree of activity in the virus, the contiguity of the part bitten to the salivary glands, or its sensibility, the ferocity of the animal inflicting the bite, or the stage of the disease when the virus is imparted, the irritability of habit, &c.

The first indication of the action of the virus is by pain or uneasiness in the wounded part, which had previously healed so as to leave scarcely a vestige of the injury, and never more than a cicatrice. In some instances the uneasiness complained of, is that of a burning or itching sensation, and occasionally red pimples have appeared immediately over the marks of the dog's teeth. These slight preliminary affections are soon followed by lancinating pains along the limb in which the virus was received, extending gradually throughout the body, and are felt particularly in the region of the stomach, with heaviness of the head, and dejection of spirits. Concomitant on this state, or directly succeeding to it, are a sense of coldness, pallid face, frequent yawnings and stretchings, acute pains in the bones and muscles resembling rheumatism, particularly in the back and extremities, considerable tremors, lassitude and disinclination to muscular exertion, with an expression denoting anxiety, timidity, and even terror. In the further progress of the case, the alimentary canal becomes more seriously affected, as is manifested by thirst, perversion of taste, flatulence, sour eructations, acute pain about the scrobiculus cordis, a burning in the stomach, nausea, and vomiting, in which a glutinous brown matter or porracious bile is discharged.[†]

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[*] London Medical and Physical Journal, July, 1828.

[†] Boerhaave.

The pulse at this time is usually disturbed, not so much by the febrile movement, as that it is quick and irregularly disordered, and the skin is mostly cold, or temperature is unequally diffused. Great tightness of the præcordia is felt, and the respiration embarrassed by constriction, or seemingly from heavy pulmonary congestion. It is now, though sometimes earlier, a sense of stricture about the throat is experienced, causing pain and difficulty of deglutition, especially of fluids,* and from the recollection of the suffering from preceding attempts to swallow, such an aversion is induced that the sight of fluids, or any transparent object as a mirror, which renews the association, creates the most afflicting suffering, and often spasms and convulsions.

In a more advanced stage of the disease, the preceding symptoms are increased, and some new affections added. Generally the patient will be found sitting up, as his distresses are aggravated by a recumbent posture. Exhausted, however, after a while, he sinks into his bed and endeavours to sleep. But this, which is rarely obtained, is of short duration, and disturbed by frightful dreams. The sensibility of the system henceforward becomes so exquisite that it cannot bear the slightest impression. Light is painful to the eyes, and on the whole sentient surface, air of a medium temperature produces sensations of chilliness, and a draught of it, or any sudden noise may excite convulsions. It is impossible to contemplate the situation of a patient at this stage without emotions of horror and regret. To all we have said is added an aspect ghastly and full of despair. The muscles of the face are distorted, the eyes fierce, "dismally wild, red, and inflamed," with the pupil much dilated, gaping of the mouth, lolling of the tongue, which is dry or rough, with a collection of froth about the mouth, attended by great heat and thirst, which cannot be allayed, for the very sight of water excites violent spasms, and often madness, and in this frensied moment endeavours are seemingly made to spit the frothy slaver upon the attendants. Constantly now do spasms and convulsions recur, and from stricture of the glottis a peculiar noise is heard, which a prepossessed or excited imagination might compare to the barking of a dog. The spasms which pervade the whole system attacking the muscles of the lower jaw, inducing a sort of chattering of the teeth, has been represented as a disposition to bite. But any tendency of the kind does not exist. Towards the close of the disease, strangury frequently occurs, and some writers take notice of the "venerii frequens—erectio, cum seminis involuntarii jactu," and now the scene closes with a weak and thready pulse, cold extremities, clammy sweats, deep sighing, hiccup, and finally a fatal convulsion.

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* There is rarely much difficulty in swallowing solids.

It is in this way, according to our own experience, which is pretty ample, that it runs its course. But it sometimes varies its character, and presents some deviations from its ordinary tenor and appearance. Thus it has happened throughout its career, that no trace of vascular irritation or excitement could be discerned, while in other instances, fever has decidedly prevailed with considerable topical affection of the stomach, the lungs, or brain. There is also no little difference in the maniacal condition, sometimes occurring in the very beginning, and continuing with temporary intermissions through every stage of the case, and it has been remarked that the faculties and senses were unimpaired to the last moment of existence.* Nor is the aversion to fluids so generally held as pathonomic of the disease, an universal concomitant. Many cases on the contrary, are reported in which it did not exist, and by some of the highest authorities of our science.† It is indeed stated by MORGAGNI, that patients in some instances are so far from having any dread of water, that they solicit to have it brought to them.

By reviewing the preceding account of hydrophobia, we can rarely be embarrassed in distinguishing it from its kindred affections. It most closely resembles certain forms of hysteria, and tetanus particularly. There are certain symptoms, however, of the former, such as the alternation of crying and laughing, so peculiar to it, that independently of other evidence, we may arrive at a just discrimination with considerable facility. As to tetanus, the difficulty is greater, and we are required to institute a very careful analysis and comparison of symptoms. The details of the diagnosis we shall postpone till we come to the consideration of that disease, and shall now only remark, that the most distinctive characteristic is the difference in the nature of the spasm in the two cases, being in the one milder, followed by relaxation, and in the other tremendously violent, and in the interval still retaining an unrelenting rigidity. Even more perplexing are some of the cases of spontaneous hydrophobia, so intimate is the analogy, and we can only attain to any degree of certainty, by recurring to the mode of production, to ascertain, whether it be from the bite of a rabid animal, or otherwise.

The prognosis in this disease is at all times most unfavourable. It has hitherto indeed proved the least tractable of morbid affections. No cure well authenticated of genuine hydrophobia, has ever been effected so far as our inquiries have extended, and in which opinion we are sustained by the very best medical authority. It is true, that cures have at different times been reported, and some of which are very confidently affirmed by respectable practitioners. But on strict scrutiny it will be perceived that they were not of the real or traumatic form of the disease, and generally consisted of a modification of tetanus or hysteria, or some other nervous or spasmodic affection. True hydrophobia therefore remains to defy our skill, the most conspicuous of the opprobria medicorum, and he who avers the contrary, deceives himself.

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* Cesalpinus, Salius, Codronchius, Aromatorius.

† Hildanus, Meade, Lieutaud, Arnold, &c.

Dissection has been practised to a considerable extent in hydrophobia, and the phenomena disclosed amply detailed. These of course vary in different cases.

In the brain the effect of a copious determination of blood is evinced, the vessels of the substance being distended, and large extravasations deposited in different parts of its structure, while the meninges are more or less inflamed, and serous effusions are met with in the ventricles.*

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* "Dissections generally discover the vessels of the brain distended, the sinus longitudinalis full of fluid blood, not coagulated, as usual in most other diseases of the head; the brain and spinal marrow drier than ordinary; the pericardium without liquor, the lungs loaded, the arteries full of blood very fluid, and hardly concrescible in the open air."—*Meade, p.* 82.

"The dura mater contained within its sinuses concretions; beneath this membrane were some bubbles of air. All the vessels of the brain were full of blood so that the choroid plexuses were black; there was no extravasation of serum. The substances of the cerebrum and cerebellum were rather dry than moist." —*Morgagni, p.* 167.

"In the meninges the vessels were extremely distended with blood, and the internal surface of the brain was every where distinguished with bloody points, and a kind of bloody filaments. In the lateral ventricles was a small quantity of serum, and that a little reddish."—*Ib. p.* 160.

"The vessels of the meninges, both arterial and venous, were immoderately full of blood, and that, as it was in every other part, very black. In the ventricles of the brain, there was a yellowish water, to about the quantity of three ounces."—*Ib. p.* 172.

"There was a distention of the pia mater on the surface of both hemispheres with a limpid fluid. The quantity of fluid in the lateral ventricles at the basis of the brain, and round the spinal marrow, appeared to be somewhat unusual." —*Ferriar's Med. Hist. p.* 205.

The following was the result of several dissections, communicated by Mr. J. Fabbroni to Sir Joseph Banks.

The lungs have been noticed phlogosed in their coverings, and adhering to the neighbouring parts. But the most uniform appearance is heavy engorgement, giving to them a dark colour with vesicles on the surface, as if raised by cantharides. Marks of inflammation are also seen in the diaphragm. The heart has seldom been found affected, except perhaps in a single instance by an adhesion to the pericardium. More commonly the ventricles are filled with coagula of blood. The large arteries emanating from it are usually distended with fluid blood, so much dissolved as scarcely to be concrescible when exposed to the atmosphere, and the veins nearly empty.[*]

"The viscera were uniformly healthy, except in one subject, in which the lungs were found adhering to the pleura; but in all of them, the brain was observed to be more loaded with blood than usual."—*Lond. Med. Journal, Vol. X.*

[*] "The lungs appeared wonderfully distended and inflamed with the black blood with which they were swollen throughout."—*Hernand. rerum mex. Med. Thesaur. p.* 494.

"The lungs on all sides cohering with the pleura, were filled with a mass of concreted blood, which rendered them impermeable, or stuffed up, and when cut into, they appeared as a clot of blood."—*Bonet. Sepul. Anat. tom. I. p.* 342.

"The lungs on their whole posterior part, were not only black, but even swollen from the blood, as it seemed stagnated within them."—*Morgagni.*

"Pulmo pleuræ adhærens concreti sanguinis molem referebet."—*Lieutaud, Hist. Anat. Med. tom. I. p.* 445.

"Pulmones coacervato omni fere cruore incredibiliter plenos."—*Boerhaave, Aph.* 1146, *vol. I.*

"Inter cadaveris, exenterationem, occurit vesi cula fellis bile nigerrima repleta, pulmones conspiciuntur nigri et graveolentes."—*Lieutaud, p.* 515.

"In the thorax, the lungs, to use the words of Boerhaave, were coacervato omni fere cruore incredibiliter plenos, 'that is, incredibly filled with almost all the crassamentum of the blood, collected and condensed together,' and in their back part, might even be said to be affected with gangrene."—*Morgagni,* 171.

"There were some adhesions of the pleura covering the right lobe of the lungs, to that lining the ribs, on the same side: the left lobe was so completely filled with blood as to have acquired considerable weight and solidity."—*Ferriar's 2d case.*

"The left lobe of the lungs was black, with the vesicles full of black blood: the surface in some places, which the blackness had not covered, appeared blistered, or if raised by cantharides."—*Philos. Trans. quoted by Ferriar.*

"In the lungs there was evidently an accumulation of blood, and more in the right side than in the left. The pleura in its natural state, but the vessels on the surface of the diaphragm, seem rather more turgid than usual."—*Babington's case.*

The stomach exhibits much evidence of diseased action, and among other appearances there is discovered in it a quantity of dark offensive fluid, its mucous coat phlogosed even to mortification, extending down to the duodenum. The large intestines are often loaded with fecal matter. Neither the liver nor urinary bladder entirely escapes inflammation.[*]

As to the parts in and about the throat, they are described as suffering materially. The pharynx, the œsophagus, the larynx, and part of the tracheal tube, have been all observed either diffusively inflamed, or dotted with livid spots. But the most striking peculiarity which has been remarked in such examinations, is an uniform want of moisture throughout the solids, amounting to absolute dryness, in many instances.[†]

The preceding history is derived chiefly from the older writers, who having cultivated morbid anatomy with less care, their reports are in

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"In the lungs were found considerable marks of inflammation."—*Cullen's Clinical Lectures, p.* 173.

"Lungs much inflamed, and towards the back part, of a livid appearance." —*Rhode's case, from Hamilton,* 365.

[*] The following is the result of Morgagni's dissections, relating to the stomach: "The stomach once turged with air, and its vessels distended with blood: its internal coat once *corrupted,* and the others distinguished with red spots; five times, indeed, a moisture was observed in it; but once much, three times little, once yellowish, once green, once of a yellow colour, degenerating into green, once extremely yellow, once cineritious, twice viscid, once not viscid."—*P.* 176.

In Ferriar's first case, the stomach exhibited marks of inflammation, "*and was half full of a dark fluid.*"—*Med. Hist.* 206.

"On opening the stomach, the villous coat was found to be generally inflamed in irregular points, and there was an appearance of abrasion, similar to that remarked in Johnson, my former hydrophobic patient."—*Ferriar's 2d case.*

"Non tantu œsophagus, sed et ventriculus, et intestina inflammata rubescebant in alio cadavere."—*Hernand. rer. Mex. Thesaur.*

In a dissection of a case which I attended, the stomach exhibited many marks of inflammation. "It also contained the dark fluid which so frequently occurs in yellow fever." This case is detailed in the Medical Repository.

[†] An inflammation of the organs of deglutition is noticed by Van Swieten as a very common occurrence.—*Comment. Vol. III. p.* 561.

Meade relates, "that the fauces were greatly inflamed."

Fauvry also mentions the "gula being inflamed, and the linea aspera in some measure also." "The fauces were found much inflamed."—*Philos. Trans. Vol. V. p.* 369.

Inflammatory appearances have also been remarked in the œsophagus, pharynx, and larynx, by Morgagni, Zwingerius, and other writers.

some degree to be distrusted. By more recent and accurate inquiries we are taught that the disease mostly expends itself on the spinal marrow, which is usually inflamed in its coverings as well as substance, with sometimes copious effusions. They also report the mucous lining of the stomach, especially about the pylorus, as phlogosed, and the pharynx and larynx pretty much in a similar condition. Dissections have however been lately made, in which scarcely a morbid appearance could be detected. Not many years ago we attended the examination of the body of a woman who died of a most violent attack of the disease on the third day, and though the inspection was most thoroughly conducted, no trace whatever could be discovered of inflammation or its consequences in any one part. The contents of all the cavities, including that of the spine, were perfectly sound, and the only change perceivable was an universal aridity of the solids—the muscles especially, on dissection, being as dry, florid, and polished, as they become when exposed to the air for some time.

We are now prepared, by these prelusive investigations, to consider the pathology of hydrophobia, and it need scarcely be remarked that the disease continues to be involved in extreme obscurity. Cullen says with respect to it, "I find I can say nothing satisfactory to myself, or that I can expect to prove so to others."

Though we have undoubtedly improved our knowledge since the time of that illustrious teacher, we apprehend, that in the spirit of candour, we shall be compelled to essentially the same confession, or should we, from our superior intelligence, claim some advances, we dare not say, that we can approach to certainty and truth on the subject.

In the speculations on the nature of hydrophobia, it has long been regarded almost exclusively as being either nervous or inflammatory, and on this question much controversy has prevailed. Discussions of such abstract propositions, are productive usually of little utility, and which is strikingly exemplified in the present instance. Not a ray of theoretic light has been shed by these disquisitions, to direct the treatment of the disease, and we are as much embarrassed on this point as before they were commenced. But in the very recent discoveries, relative to the nervous system, we have opened to us a view, which may hereafter, perhaps, by further cultivation enable us to construct a better pathology, and pursue a more successful practice, in this hitherto indomitable disease.

It is now ascertained, that muscular action is influenced chiefly by the nerves which are derived from the spinal marrow, and to that source must we look for an explanation of the leading and principal phenomena of the disease. The virus acting primarily on these nerves, produces lassitude and painful uneasiness, soon followed by tremors, and ultimately by spasms and convulsions. But such is the intimate communication between the whole of the nervous system, that the morbid irritation becomes extended to other portions of it, presenting a case of greater complication, and more diversified symptoms. The dejection of spirits, the fearful anxieties, in the early, and the delirium and even frantic rage, of the more advanced stages of the case, manifest cerebral disorder, and the affection of the stomach, its sensibility, nausea, and vomiting, with the heavy congestions in other organs, particularly the lungs, equally attest that the ganglionic nerves are implicated. As to the difficulty of deglutition, and aversion to fluids, these are compound phenomena, produced by a mixed nervous agency. The muscles subservient to deglutition, are supplied from the cervical nerves, and on which their muscular action is dependent. But swallowing is a voluntary act, and in order that the muscles performing it should be obedient to the will, they also are furnished with numerous ramifications from the fifth pair, which are cerebral nerves. Now the influence of the former being interrupted by an affection of the spinal marrow, the muscles of deglutition, from the want of such influence, can no longer harmoniously co-operate in the execution of that function. But on the contrary, when the stimulus of volition is applied to these through the latter nerves, their own organic irritability is only excited, and instead of acting in unison, they are thrown into the most irregular and convulsive movements, entirely frustrative of the attempt to swallow. The horror of fluids is a mere mental emotion, which was formerly explained. As for the extraordinary aridity of the solids, amounting to absolute dryness, in some instances, it has hitherto been ascribed to the deprivation of drink. But having witnessed the same condition in a case, where it was constantly administered, this explanation fails, and it is more probably owing to a suspension of secretory action, from an interruption of nervous agency, by which the fluids are eliminated.

As described, such appears to be the order of nervous irritations, constituting this disease, and much further in the development of its pathology, we cannot proceed. It may be vaguely affirmed, that the virus being of a specific character, its effects must be the same, which is only a barren truism. But similar language is held in relation to other virus's, and the essence of hydrophobia is wrapt in not deeper mystery than those of syphilis, variola, vaccina, and some other analogous cases. *Dies doceat*, and we must look to the revelations of the future, for the solution of the problem.

It has been made a question, in what manner does the virus operate? By many it is still supposed, that it is absorbed into the circulation, and thus produces its effects, than which no hypothesis is less sustained by fact or analogy. All morbid affections as is strikingly illustrated in such as originate in inoculation, commence at a point, and are extended through the medium of sympathy or association, till more or less of the system is brought into participation, inducing what is called a general disease. It would seem, that hydrophobia in all its stages, is characterised by a predominance of nervous irritation, and such a condition cannot exist without inviting an afflux of blood to parts most highly irritated, and hence in its progress, congestions and inflammation take place. But this explanation of these phenomena, is perhaps only applicable to the early stage of the case, and at all events another cause, the want of adequate nervous energy, is much concerned in their production. Experiments demonstrate that wherever this happens by the destruction of the nerve, or by a ligature, or any other mode intercepting the supply, the organ labouring under the disability, uniformly falls into collapse, and fills with dark, undecarbonised blood. No stronger example of this can can be given than the asphyxia, with engorged lungs, induced by cutting or tying the eighth pair of nerves. It is this condition of organs, with a correspondent disturbance of the circulation, and other functions, which has led some to view the disease as essentially of a phlogistic and febrile nature.

We come now to the treatment of the disease, and which may be divided into prophylactic, or the means of prevention, and therapeutic, or plan of cure, after the virus has taken effect, and the case is developed. To meet the first indication, the ancient practitioners preferred an application of the actual cautery to the wound, converting it afterwards into a running sore, by irritating dressings—then instituting a course of the veratrum or white hellebore, with the use of the cold bath. The latter was also confided in by VAN HELMONT, BOERHAAVE, VAN SWIETEN, and by most of their cotemporaries and successors, for a considerable period, without, however, any satisfactory evidence of its utility.

As to the treatment of the disease itself, reliance was chiefly placed in the hellebore, as appears from the writings of ACTIUS, PAULUS, AEGINETA, ACTUARIUS, &c. Besides this, however, there were various other remedies, many of them of quite an empirical character, all of which, with the hellebore, have long since been exploded. To the *Cineres Cancri Usti*, the most popular nostrum of that day, succeeded the specific of Mayerne, consisting chiefly of pewter filings—then DAMPIER's powder, which had the sanction of Meade, though composed of ingredients entirely inert—next the Tonquin remedy, composed of cinnabar and musk, followed by the Ormskirk medicine, the basis of which were chalk and elecampane root, with a variety of other nostrums—including the notorious Chinese snakestone of our own country, etc. equally devoid of just pretensions to efficacy.

Not the least promising means of obviating this terrible disease, would seem to be a mercurial course, and hence it attracted much attention, and has been amply tried, with results, however, so various and contradictory, that the confidence it once inspired, has gradually worn away, and at present we believe it is universally distrusted, and perhaps abandoned. It is not difficult to account for mercury, and even remedies of the most preposterous kind, having acquired, and sustained a temporary credit as preventives of hydrophobia, when we consider that only a portion of those that are bitten by a rabid animal, are perhaps, susceptible at the time to the disease—that the bite is generally through clothing, which intercepts the virus—that when it is actually inserted into a wound, it may be inoperative, and that there is often great reason to doubt the madness of the dog. It is remarked by Mr. HUNTER, that he knew "where twenty-one people were bitten by one dog, nothing was done for them, and only one became affected." By Hamilton we are also told, that in one instance four men and twelve dogs were bitten by the same animal, the former entirely escaping, and all the latter went mad. Now, had these persons been under medical care, the remedy used, would have had the merit of the prevention, and under such a delusion its fame become widely spread, and falsely trusting to it, the mischief co-extensive. It is in this way, by loose and incautious inferences, that medical testimony is rendered uncertain, and even so proverbially fallacious, that it should never be fully received till it is rigorously scrutinized, and especially as a foundation of practice.

Discarding then, all other prophylactic means as totally inert in which estimate of their inefficacy, we have reason to suppose, we are well sustained, the following course should be pursued, as affording the best, and perhaps only security.

The bitten part is first to be wiped, so as completely to remove all the slaver of the animal, and then the whole wound is to be excised, taking care, in prosecuting the dissection, that the scalpel is cleaned after each cut, so as to prevent any further inoculation from the virus which might adhere to it. Having thus carefully performed the operation, the wound should be thoroughly washed, by pouring water on it from the spout of a tea-pot or kettle, which being done, it is usually recommended to convert it into a suppurating sore by the application of caustic, and subsequent irritating dressings, with a view to the establishment of a drain. It has just been remarked, that in the primitive practice in this case, the actual cautery was employed, and which is pointedly recommended by VAN HELMONT, STAHL, MORGAGNI, and very recently by MANNOIR MAROCHETTI and ORFILA, though we doubt on any just grounds of preference. The object is the same, the establishment of an issue or drain, and as to the means, it is not material which of the two is selected. But we concur with many by whom the practice is condemned as painful and nugatory, and would never resort to it. Be the utility of it as it may, it is very questionable whether the principle which dictates it be correct. It seems to us far more likely, that the occasional success of such treatment is to be assigned to the change which is effected in the nervous sensibility of the part, preventing the extension of the original irritation, and thereby stifling the disease at the initial point, exactly as in the case of tetanus. As well from a priori reasonings, as the evidence of recent experiments, we should attach much greater importance to pressure on the part of such force as might deaden its sensibility, or, in other words, to occasion a partial paralysis of it. Exhausted cups over the part, so much commended of late in poisoned wounds, and which, we think, have been shown to operate in this mode, and not by the interruption of absorption by the removal of atmospherical pressure, we should deem less appropriate to this particular case, the effect being only temporary, and the latent period of the hydrophobic virus indefinitely protracted.

To the universal employment of the practice suggested, there may be objections, or the occurrence of circumstances to interfere with its adoption. "Thus much time may be lost before the arrival of a surgeon, the patient may resist all solicitation to submit to the knife. The wound may have been inflicted on the face, or near some large blood-vessel, or there may be so little probability of the madness as to render it unjustifiable to subject the individual to present pain, and future deformity." In certain of these contingencies, we must be content with copious ablutions, so as completely to wash out the bite. But however remote may be the date of the bite, let not the excision, and other precautionary measures, already enumerated, be omitted, when considered as warrantable by the situation of the wound, or presumptive danger.

As regards other parts of the prophylaxis, not much need be said. It may be proper to regulate the diet, and to avoid all undue excitements. To dissipate alarm, and inspire confidence in his security, are considerations of the last importance to the patient. The operation of fear in exciting many diseases is well known, and examples are so numerous of a condition of the nervous system very closely resembling hydrophobia, and sometimes proving fatal, having been induced principally by depression of spirits from idle apprehensions of its actual occurrence, that some respectable writers have gone to the extent of maintaining, that the disease in the human subject, is always thus brought on, and is merely an hallucination of the mind. Denying the truth of an unqualified hypothesis of this sort, it must still be conceded, that uniformly great anxiety prevails, which often tends to lamentable consequences, and should be studiously guarded against by all possible means.

Concerning the cure of the disease when once formed, we are embarrassed what to say. As previously intimated, there is no one remedy or system of practice hitherto proposed, on which we can rely, or which candidly viewed, seems entitled to preference. To detail the progress of opinion, or recount the modes of cure which have prevailed, would be to repeat the history of error, and would prove a melancholy record of the uncertainty of medical statements, and we shall decline so unprofitable a task.

Two plans of treatment have, in comparatively modern times, been pursued, drawn from those opposite views of the nature of the disease, which were formerly noticed, as now chiefly entertained. Considered by one set of pathologists as consisting in spasm from debility, every plausible means of stimulation were resorted to, and most actively employed. It was then that opium, musk, camphor alone or variously combined, and wine and other alcoholic liquors were principally relied on, aided by bark, valerian, and the whole tribe of tonics and antispasmodics. Nor has mercury been neglected. The fairest trials on the contrary have been made of it, and with no better success than the preceding articles, all of which were impotent to the relief of a single case. It ought not perhaps to be omitted that Moseley has reported two instances of the disease cured by mercurial inunction in which salivation took place, in the one in twenty-four, and in the other in forty-eight hours. Not knowing the particulars of these cases, we cannot pretend to determine how far they were genuine, or otherwise have claims to attention. But they were little regarded at the time of publication, have never been insisted upon as evidence of the efficacy of the remedy, and probably are without authority. Moseley at that period had from an unhappy combination of circumstances, fallen from his former high estate, and became low indeed in general estimation. The victim of adverse fortune, his moral character was impaired, and his intellect so weakened, that he proclaimed under the sanction of his name, the extraordinary hypothesis, that from the practice of vaccination, the human species would ultimately degenerate into the cow, in support of which he adduced many facts of the commencement of the process of transformation. Can the statements of such a man on any subject be credited?

Encouraged by the authority of Boerhaave, who had taught the inflammatory character of the disease, a different practice came to be pursued. Discarding stimulants—venesection and other means of depletion were directed most freely, and in some instances to an extraordinary extent, even *ad deliquium animi*, with however no greater advantage. It is true that cases have been reported of its success, a collection of which may be found in the works of the late Professor Rush. But these are not considered as instances of genuine traumatic hydrophobia, several of them undoubtedly not, being hysteria or other nervous affections, and the whole of them labouring under the defect of a perfect authentication. The practice has, moreover, been tried and found wanting, in every recent application of it, as well here as elsewhere. Thirteen cases of the disease we have seen either under our own care, or that of our medical friends, three of which were treated by the late Professor Rush, where venesection was carried as far as possible, and the conclusion from all this experience is, that not the slightest benefit accrued, even the mitigation of a solitary affection from that or any other remedy employed.

An analysis of the cases reported to have been cured by venesection might prove interesting, had we time to devote to the purpose. But it has already been well done by Dr. Mease, to whose paper, in the Medical Recorder, Vol. II. we must refer such of our readers as are curious on the subject. To a certain extent our estimate of the remedy is confirmed by Dr. Rush himself, whose opinion has more force, as at one period he anticipated a complete triumph over the disease from its liberal use. "The theory of the disease," says he, "would lead us to expect a remedy for it in blood-letting. But this, though now and then used with success, is not the cure, owing, as we now see, to the morbid seat of the disease being so far removed from the circulation as not to be affected by the loss of blood in the most liberal quantity. As well might we expect the inflammation and pain of a paronychia, or what is called a felon on the fingers, to be removed by the same remedy."

Belonging, however, exclusively to neither of these plans, various remedies at different times have been tried which here might be enumerated, were they deserving of notice. Perhaps, however, a word may be said of the super-acetate of lead, from the use of which a cure is said to have been made in Baltimore within the last few years. How far this is true, we are not sufficiently acquainted with the facts of the case to determine. But the practice completely failed in two recent cases in Charleston and London.* Dismal as this account is, of the incurability of hydrophobia, we cannot relieve its dark shades, by one bright tint, consistently with candeur and truth.

Encountering hereafter the disease, we would change the treatment very considerably. Being called in the early stage of it, we should proceed exactly as if the infection were just received, excising the part, and applying cups or heavy pressure on it so as to destroy its nervous energy. By doing so, we might check the further progress of the attack, in the same way, as the removal of the irritation of a wound, puts an end, in some instances, to the series of convulsive motions which constitute tetanus. It ought, however, to be practised as early as possible, for the consecutive trains of morbid action being once established, they then become independent of the original irritation, and cannot be so readily, if at all subverted. Do we not sometimes arrest altogether lues venerea by the destruction of chancre, though the latter may have existed long enough to have excited bubo or some other affection consequent on the primary irritation? and are we not equally apprised of the fact that the same thing happens with respect to vaccination? Let not this suggestion at least be disregarded as unworthy of attention in the present poverty of remedial resources. Nor ought a failure or two, to discourage from further trials, since the same has happened with the operation when instantly performed, though in the general result successful.

As the spinal marrow appears to be early and seriously affected, it were well to endeavour to reinstate its healthy functions, and for this purpose no measure would probably be so effectual as leeches or cups to be succeeded by a strip of epispastic plaster or issues, or the actual cautery along the vertebral column, and it is not unlikely that some advantage might be derived from counter irritation over the epigastrium. To prevent or check convulsive spasms, compression by tourniquets to an upper and lower extremity on opposite sides is worthy of trial, and more especially as it has answered so well in epilepsy, and in the inveterate attacks of cholera morbus. Death sometimes seemingly happens very suddenly from spasm of the glottis, and where it is menaced from this cause tracheotomy may be performed, as suggested originally by Professor Physick.

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* London Medical and Physical Journal, July, 1828.

In the use of general remedies, we should be governed by circumstances, resorting to venesection and evacuants of the alimentary canal, or to stimulants and antispasmodics, or sedatives as indicated, alone, or united with calomel. Great embarrassment has heretofore been complained of in the administration of medicines, from the inability of deglutition, or the intractable spirit of the patient. But this may be readily overcome by the introduction of the œsophagus catheter, through which medicines, drink and food, are very conveniently poured into the stomach, as we witnessed in one case of the disease. Nothing could exceed the apparent comfort and refreshment which the patient experienced from broth, and particularly cold water, with which she was supplied in this manner, throughout her illness. In the last few years we have heard much of the success of an experiment by Majendie, in which a large quantity of water was injected into the veins. But we do not confide in it, as highly improbable, and particularly since it failed in other hands.*

We have now completed the consideration of this subject, which, perhaps, has been treated more extensively than it claimed, from the uncertainty of our knowledge regarding it. But it is one of intense interest, in whatever view it may be contemplated—and we deemed it proper to lay open the whole field, with the hope that it may receive some cultivation and improvement. No where is the disease, probably of more frequent occurrence than in the United States, and from the ample opportunities afforded, we will not despair of seeing it further elucidated by the well-directed investigations of some of our practitioners. To determine correctly the pathology, and to indicate with any certainty, the cure of hydrophobia, are to wipe away a reproach to our art, and to earn a reward as much more glorious than the oaken wreath awarded by the Roman Senate to a soldier who saved an individual in battle, as the preservation of the lives of thousands is to that of one, or the triumphs of science compared with a solitary achievement of military intrepidity or prowess.

N. C.

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* Vide a report of a case of hydrophobia, by M. Gaspard, in which an injection of water into the veins, so far from affording relief, most manifestly did injury by depressing strength, and exciting a chill and fever.—*Lancet, Vol. II. p.* 363.